United Nations ECE/TRANS/WP.29/GRVA/2018/4

Economic and Social Council

Distr.: General
16 July 2018

Original: English

Economic Commission for Europe

Inland Transport Committee

World Forum for Harmonization of Vehicle Regulations

Working Party on Automated/Autonomous and Connected Vehicles*

First session
Geneva, 25-28 September 2018
Item 7 of the provisional agenda
Advanced Emergency Braking Systems

Proposal for a new series of amendments to UN Regulation No. 131 (Advanced Emergency Braking Systems)

Submitted by the expert from Germany**

The text reproduced below was prepared by the expert from Germany with the aim to clarify the Advanced Emergency Braking Systems (AEBS) requirements over the whole operation speed range, as well as to increase the performance requirements for AEBS and modify the conditions for a deactivation of the AEBS function by the driver. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

* Formerly: **Working Party on Brakes and Running Gear (GRRF)**.

** In accordance with ECE/TRANS/274, para 52), with ECE/TRANS/WP.29/1139, para. 33 and with the programme of work of the Inland Transport Committee for 2014–2018 (ECE/TRANS/240, para. 105 and ECE/TRANS/2014/26, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

GE.18-11632(E)

1811632

Please recycle

I. Proposal

UN Regulation No. 131, main text (without annexes), amend to read:

"UN Regulation No. 131

Uniform provisions concerning the approval of motor vehicles with regard to the Advanced Emergency Braking Systems (AEBS)

Contents

Page

Introduction (for information) 3

1. Scope and purpose 3
2. Definitions 4
3. Application for approval 5
4. Approval 5
5. Specifications 6
6. Test procedure 10
7. Modification of vehicle type and extension of approval 13
8. Conformity of production 14
9. Penalties for non-conformity of production 14
10. Production definitively discontinued 14
11. Names and addresses of the Technical Services responsible for conducting approval tests and of Type Approval Authorities 14
12. Transitional provisions 15

Annexes

1 Communication 14

2 Arrangements of approval marks 14

~~3 Warning and activation test requirements - Pass/fail values ..... 14~~

3 Special requirements to be applied to the safety aspects of complex electronic vehicle control systems 14

Introduction (for information)

The intention of this UN Regulation is to establish uniform provisions for advanced emergency braking systems (AEBS) fitted to motor vehicles of the categories M_2, M_3, N_2 and N_3[1] primarily used under highway conditions.

While, in general, those vehicle categories will benefit from the fitment of an advanced emergency braking system, there are sub-groups where the benefit is rather uncertain because they are primarily used in other conditions than highway conditions (e.g. buses with standing passengers i.e. Classes I, II and A[1]). Regardless from the benefit, there are other sub-groups where the installation of AEBS would be technically difficult (e.g. position of the sensor on vehicles of category G and special purpose vehicles, etc.).

~~In addition, systems intended for vehicles not equipped with a pneumatic rear axle suspension require the integration of advanced sensor technology to take into account the variation of the pitch angle of the vehicle. Contracting Parties wishing to apply this Regulation to these vehicles should provide adequate time for this.~~

The system shall automatically detect a potential forward collision, provide the driver with a warning and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating the severity of a collision in the event that the driver does not respond **sufficiently quickly** to the warning.

The system shall only operate in driving situations where braking will avoid or mitigate the severity of an accident, and shall take no action in normal driving situations.

In the case of a failure in the system, the safe operation of the vehicle shall not be endangered.

The system shall provide as a minimum an acoustic or haptic warning, which may also be a sharp deceleration, so that an inattentive driver is made aware of a critical situation.

During any action taken by the system (the warning and emergency braking phases), the driver can, at any time through a conscious action, e.g. by a steering action or an accelerator kick-down, take control and override the system. **The system shall be able to distinguish conscious actions from non-conscious actions, e.g. driver movement that is a reaction to haptic warnings and / or the emergency braking phase.**

The Regulation cannot include all the traffic conditions and infrastructure features in the type-approval process. Actual conditions and features in the real world should not result in false warnings or false braking to the extent that they encourage the driver to ~~switch the system off~~ **ignore warnings or endanger other traffic participants**.

1. Scope and purpose

This UN Regulation applies to the approval of vehicles of category M_2, N_2, M_3 and N_3[1] with regard to an on-board system to avoid or mitigate the severity of a rear-end in lane collision.

[1] As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.6, para. 2.

2. Definitions

2.1. "*Advanced Emergency Braking System (AEBS)*" means a system which can automatically detect a potential forward collision and activate the vehicle braking system to decelerate the vehicle with the purpose of avoiding or mitigating a collision.

2.2. "*Vehicle type with regard to its Advanced Emergency Braking System*" means a category of vehicles which do not differ in such essential respects as:

(a) The manufacturer's trade name or mark;

(b) Vehicle features which significantly influence the performances of the Advanced Emergency Braking System;

(c) The type and design of the Advanced Emergency Braking System.

2.3. "*Subject vehicle*" means the vehicle being tested.

2.4. "*Target*" means a **target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision. It shall be representative for a** high volume series production passenger **compact** car of category M_1 AA saloon[1] ~~or in the case of a soft target an object representative of such a vehicle~~ in in terms of its detection characteristics applicable to the sensor system of the AEBS under test, **such as the target object as specified in ISO [WD] 19206-3.**

2.5. "*Moving target*" means a target travelling at a constant speed in the same direction and in the centre of the same lane of travel as the subject vehicle.

2.6. "*Stationary target*" means a target at standstill facing the same direction and positioned on the centre of the same test lane of travel as the subject vehicle.

~~2.7. "*Soft target*" means a target that will suffer minimum damage and cause minimum damage to the subject vehicle in the event of a collision.~~

2.7. "*Collision warning phase*" means the phase directly preceding the emergency braking phase, during which the AEBS warns the driver of a potential forward collision.

2.8. "*Emergency braking phase*" means the phase starting when the AEBS emits a braking demand for at least 4 m/s² deceleration to the service braking system of the vehicle.

2.9. "*Common space*" means an area on which two or more information functions (e.g. symbol) may be displayed, but not simultaneously.

2.10. "*Self-check*" means an integrated function that checks for a system failure on a semi-continuous basis at least while the system is active.

2.11. "*Time to collision (TTC)*" means the value of time obtained by dividing the distance between the subject vehicle and the target by the relative speed of the subject vehicle and the target, at an instant in time.

2.12. ***"Reaction time"* means the time between the warning signal is given and actuation of the brake pedal by the driver. The value for the reaction time shall be [1.4] seconds.**

2.13. ***"Normal driving brake application"* means the brake control behaviour that typical drivers perform in regular traffic. It shall be assumed that**

typical braking behaviour is a brake application of [3] m/s², applied within [1] second.

2.14. **"*Emergency brake application*" means the brake control behaviour that typical drivers perform in response to a forward collision warning. It is expected that drivers fully apply the brake up to the vehicle's deceleration limit after the reaction time has elapsed.**

2.15. **"*Dry road*" means a road surface offering a peak braking coefficient of no less than 0.9.**

2.16. **"*Wet road*" means a wet road surface offering a peak braking coefficient of no less than 0.4.**

2.17. **"*Relative Impact Speed*" means the relative speed between subject vehicle and target at the time of impact.**

2.18. **"*Impact Speed*" means the speed of the subject vehicle at the time of impact.**

2.19. **"*Filtered vehicle deceleration*" means the vehicle deceleration signal, filtered with a 6-pole phaseless butterworth filter and a cut-off frequency of 5 Hz.**

3. Application for approval

3.1. The application for approval of a vehicle type with regard to the Advanced Emergency Braking System shall be submitted by the vehicle manufacturer or by his authorized representative.

3.2. It shall be accompanied by the documents mentioned below in triplicate:

3.2.1. A description of the vehicle type with regard to the items mentioned in paragraph 2.2., together with a documentation package which gives access to the basic design of the AEBS and the means by which it is linked to other vehicle systems or by which it directly controls output variables. The numbers and/or symbols identifying the vehicle type shall be specified.

3.3. A vehicle representative of the vehicle type to be approved shall be submitted to the Technical Service conducting the approval tests.

4. Approval

4.1. If the vehicle type submitted for approval pursuant to this Regulation meets the requirements of paragraph 5. below, approval of that vehicle shall be granted.

4.2. An approval number shall be assigned to each type approved; its first two digits (at present ~~01~~**02** corresponding to the ~~01~~**02** series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendments made to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to the same vehicle type equipped with another type of AEBS, or to another vehicle type.

4.3. Notice of approval or of refusal or withdrawal of approval pursuant to this Regulation shall be communicated to the Parties to the Agreement which

apply this Regulation by means of a form conforming to the model in Annex 1 and documentation supplied by the applicant being in a format not exceeding A4 (210 x 297 mm), or folded to that format, and on an appropriate scale or electronic format.

4.4. There shall be affixed, conspicuously and in a readily accessible place specified on the approval form, to every vehicle conforming to a vehicle type approved under this Regulation, an international approval mark conforming to the model described in Annex 2, consisting of:

4.5.1. A circle surrounding the letter "E" followed by the distinguishing number of the country which has granted approval;[2]

4.5.2. The number of this Regulation, followed by the letter "R", a dash and the approval number to the right of the circle prescribed in paragraph 4.5.1. above.

4.6. If the vehicle conforms to a vehicle type approved under one or more other Regulations, annexed to the Agreement, in the country which has granted approval under this Regulation, the symbol prescribed in paragraph 4.5.1. above need not be repeated; in such a case, the Regulation and approval numbers and the additional symbols shall be placed in vertical columns to the right of the symbol prescribed in paragraph 4.5.1. above.

4.7. The approval mark shall be clearly legible and be indelible.

4.8. The approval mark shall be placed close to or on the vehicle data plate.

5. Specifications

5.1. General

5.1.1. Any vehicle fitted with an AEBS complying with the definition of paragraph 2.1. above shall meet the performance requirements contained in paragraphs 5.1. to 5.6.2. of this Regulation and shall be equipped with an anti-lock braking function in accordance with the performance requirements of Annex 13 to UN Regulation No. 13.

5.1.2. The effectiveness of the AEBS shall not be adversely affected by magnetic or electrical fields. This shall be demonstrated by compliance with the **05** series of amendments to UN Regulation No. 10.

5.1.3. Conformity with the safety aspects of complex electronic control systems shall be shown by meeting the requirements of Annex 4 **3**.

5.2. Performance requirements

5.2.1. The system shall provide the driver with appropriate warning(s) as below:

5.2.1.1. A collision warning when the AEBS has detected the possibility of a collision with a preceding vehicle of category M, N or O in the same lane which is travelling at a slower speed, has slowed to a halt or is stationary having not

[2] The distinguishing numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.6 - www.unece.org/trans/main/wp29/wp29wgs/wp29gen/wp29resolutions.html

being identified as moving. The warning shall be as specified in paragraph 5.5.~~1. above~~ **below**.

The timing of the warning signals shall be such that they provide the possibility for the driver to react to the risk of collision and take control of the situation, and shall also avoid nuisance for the driver by too early or too frequent warnings.

This shall be tested in accordance with the provisions of paragraphs 6.5.2. and 6.6.2. of this Regulation.

5.2.1.1.1. The warning shall be given at the latest in such a timely manner that an emergency brake application according to paragraph 2.14. (taking also into account the reaction time according to paragraph 2.12.) would lead to the vehicle avoiding collisions on constantly moving or stationary targets which are also centred in the same lane and facing in the same direction.

5.2.1.1.2. The warning shall be given at the earliest in conditions when a collision in the conditions as specified in paragraph 5.2.1.1.1. would not be avoided with normal driving brake application according to paragraph 2.13.

5.2.1.1.3. A warning may not be given in cases where the warning is necessary while typical drivers are still in full control of the situation, namely when the requirements of paragraphs 5.2.1.1.1. and 5.2.1.1.2. contradict. This is expected to occur in the low speed range.

5.2.1.2. A failure warning when there is a failure in the AEBS that prevents the requirements of this Regulation of being met. The warning shall be as specified in paragraph 5.5.4. below.

5.2.1.2.1. There shall not be an appreciable time interval between each AEBS self-check, and subsequently there shall not be an appreciable delay in illuminating the warning signal, in the case of an electrically detectable failure.

5.2.1.2.2. Failures due to temporary sensor blocking, for instance due to a mounted snow-plough, shall be detected after a driving time of maximum [300] seconds.

5.2.1.3. A deactivation warning, if the vehicle is equipped with a means to manually deactivate the AEBS, shall be given when the system is deactivated. This shall be as specified in paragraph 5.4.2. below.

5.2.2. The AEBS shall avoid collisions with moving or stationary vehicles up to speeds as specified in paragraph 5.2.2.2., and mitigate collisions as specified in paragraph 5.2.2.3.

The AEBS shall reduce the impact speed in situations with decelerating vehicles as specified in paragraph 5.2.2.4.

This shall be tested in accordance with paragraphs 6.5. and 6.6. of this Regulation.

5.2.2.1. The emergency braking shall be activated at the earliest in conditions when an accident would not be avoided by normal driver brake application as specified in paragraph 2.13.

5.2.2.2. **The emergency braking function shall be capable of avoiding collisions with stationary or constant moving targets, without any required driver activity at relative speeds up to [70] km/h on dry roads and [40] km/h on wet roads.**

5.2.2.3. **The emergency braking function shall be able to mitigate collisions with stationary or constant moving vehicles up to the maximum vehicle design speed, with a relative impact speed as function of initial relative speed between the vehicles $v_{0,rel}$, calculated by**

$$v_{impact,rel} = \sqrt{v_{0,rel}^2 - 2\left(t_{tc,Brake} - \frac{1}{2}t_{Increase}\right) \cdot v_{0,rel} \cdot a_{max}},$$

using the following values, as observed during verification of the respective conditions in paragraph 5.2.2.2:

- **maximum possible deceleration a_{max} in m/s², identified after applying a floating average filter with a time constant of 1 s or a similar filter,**
- **automatic brake activation TTC $t_{TC,Brake}$ in s, calculated using the TTC $t_{tC,4}$ at which the filtered vehicle deceleration crosses 4 m/s², the relative vehicle speed at which the filtered vehicle deceleration crosses 4 m/s² v_4 and the initial relative speed $v_{0,rel}$, according to the equation $t_{tC,Brake} = t_{tC,4} \cdot v_{0,rel}/v_{4,rel}$,**
- **brake deceleration increase time $t_{Increase}$, calculated using the time t_4 at which the filtered vehicle deceleration crosses 4 m/s² and the time $t_{a,max}$ at which the maximum deceleration is reached, according to the equation $t_{Increase} = \frac{a_{max} \cdot (t_{a,max} - t_4)}{a_{max} - 4\ m/s^2}$.**

5.2.2.4. **The emergency braking function shall avoid or mitigate collisions with decelerating targets by automatic brake application, using the value a_{max} as defined in paragraph 5.2.2.3., when an imminent collision is detected.**

5.2.3. The system shall be active at least within the vehicle speed range of 15 km/h up to the maximum design speed of the vehicle, and at all vehicle load conditions, unless manually deactivated as per paragraph 5.4. below.

5.2.4. The system shall be designed to minimize the generation of collision warning signals and to avoid autonomous braking in situations where the driver would not recognize an impending forward collision. This shall be demonstrated in accordance with paragraph 6.9. of this Regulation.

5.3. Interruption by the driver

5.3.1. The AEBS may provide the means for the driver to interrupt the collision warning phase. However, when a vehicle braking system is used to provide a haptic warning, the system shall provide the driver with a means to interrupt the warning braking.

5.3.2. The AEBS shall provide the means for the driver to interrupt the emergency braking phase.

5.3.3. In both cases above, this interruption may be initiated by any positive action (e.g. kick-down) that indicates that the driver is aware of the emergency situation. The vehicle manufacturer shall provide a list of these positive actions to the technical service at the time of type approval and it shall be annexed to the test report.

5.3.4. **The vehicle manufacturer shall demonstrate to the satisfaction of the technical service that natural driver movements generated purely by brake activations shall not lead to an interruption of the emergency braking phase.**

5.4. When a vehicle is equipped with a means to deactivate the AEBS function, the following conditions shall apply ~~as appropriate~~:

5.4.1. The AEBS function shall be automatically ~~reinstated~~ **reactivated** at the initiation of each new ignition cycle.

5.4.2. **The AEBS function shall be automatically and instantaneously reactivated if the vehicle speed exceeds 30 km/h.**

5.4.3. **The deactivation of the AEBS function shall not be possible at vehicle speeds greater than 30 km/h.**

5.4.4. A constant optical warning signal shall inform the driver that the AEBS function has been deactivated. The yellow warning signal specified in paragraph 5.5.4. below may be used for this purpose.

5.5. Warning indication

5.5.1. The collision warning referred to in paragraph 5.2.1.1. above shall be provided by at least two modes selected from acoustic, haptic or optical.

This shall be tested in accordance with the provisions of paragraphs 6.5.2. and 6.6.2. of this Regulation

5.5.2. A description of the warning indication and the sequence in which the collision warning signals are presented to the driver shall be provided by the vehicle manufacturer at the time of type-approval and recorded in the test report.

5.5.3. Where an optical means is used as part of the collision warning, the optical signal may be the flashing of the failure warning signal specified in paragraph 5.5.4. below.

5.5.4. The failure warning referred to in paragraph 5.2.1.2. above shall be a constant yellow optical warning signal.

5.5.5. Each AEBS optical warning signal shall be activated either when the ignition (start) switch is turned to the "on" (run) position or when the ignition (start) switch is in a position between the "on" (run) and "start" that is designated by the manufacturer as a check position (initial system (power-on)). This requirement does not apply to warning signals shown in a common space.

5.5.6. The optical warning signals shall be visible even by daylight; the satisfactory condition of the signals must be easily verifiable by the driver from the driver's seat.

5.5.7. When the driver is provided with an optical warning signal to indicate that the AEBS is temporarily not available, for example due to inclement weather conditions, the signal shall be constant and yellow in colour. The failure warning signal specified in paragraph 5.5.4. above may be used for this purpose.

5.6. Provisions for the periodic technical inspection

5.6.1. At a periodic technical inspection, it shall be possible to confirm the correct operational status of the AEBS by a visible observation of the failure warning signal status, following a "power-ON" and any bulb check.

In the case of the failure warning signal being in a common space, the common space must be observed to be functional prior to the failure warning signal status check.

5.6.2. At the time of type approval, the means to protect against simple unauthorized modification of the operation of the failure warning signal chosen by the manufacturer shall be confidentially outlined.

Alternatively, this protection requirement is fulfilled when a secondary means of checking the correct operational status of the AEBS is available.

6. Test procedure

6.1. General provisions

Vehicles fitted with AEBS shall fulfil the following test requirements.

6.2. Test conditions

6.2.1. The test shall be performed on a flat, dry concrete or asphalt surface affording good adhesion.

6.2.2. The ambient temperature shall be between 0 °C and 45 °C.

6.2.3. The horizontal visibility range shall allow the target to be observed throughout the test.

6.2.4. The tests shall be performed when there is no wind liable to affect the results.

6.3. Vehicle conditions

6.3.1. Test weight

During the test, the vehicle shall be loaded to its technically permissible maximum mass. If this is deemed justified, the technical service may additionally select a different load condition. No alteration shall be made once the test procedure has begun.

6.4. Test targets

6.4.1. The target used for the tests shall be a target as specified in paragraph 2.4.

If this is deemed justified by the technical service, a real vehicle may be used for non-destructive tests.

6.4.2. Details that enable the target(s) to be specifically identified and reproduced shall be recorded in the vehicle type approval documentation.

6.5. Warning and activation test with a stationary target

6.5.1. The subject vehicle shall approach the stationary target in a straight line for at least two seconds prior to the functional part of the test with a subject vehicle **centreline** to target centreline offset of not more than 0.5 m.

The functional part of the test shall start when the subject vehicle is travelling at **the test** speed ~~of 80~~ ± 2 km/h and is at a distance ~~of at least 120 m from~~ **to** the target **corresponding to a travel time of 6 s at the selected test speed.**

From the start of the functional part until the point of collision there shall be no adjustment to any control of the subject vehicle by the driver other than slight adjustments to the steering control to counteract any drifting.

Tests shall be performed at the vehicle maximum design speed, at the avoidance speed as specified in paragraph 5.2.2.2. and at each of the following speeds that is not greater than the vehicle maximum design speed: 20, 40, 60, 80, 100 km/h.

Where this is deemed justified, the technical service may select additional test speeds between 15 km/h and the vehicle maximum design speed.

6.5.2. The timing for the collision warning modes referred to in paragraph 5.5.1. above shall comply with the **provisions as specified in paragraphs 5.2.1.1.1., 5.2.1.1.2. under consideration of paragraph 5.2.1.1.3.**

6.5.2.1. At least one warning mode shall be provided ~~no later than~~ **at the latest when the emergency braking phase is activated.**

6.5.3. For relative speeds not exceeding the values as specified in paragraph 5.2.2.2., a collision shall be avoided including a tolerance of 5 km/h.

For greater values, the relative impact speed shall be as specified in paragraph 5.2.2.3., including a tolerance of 10 km/h.

~~6.4.2.3. Any speed reduction during the warning phase, shall not exceed either 15 km/h or 30 per cent of the total subject vehicle speed reduction, whichever is higher.~~

~~6.4.3. The collision warning phase shall be followed by the emergency braking phase.~~

~~6.4.4. The total speed reduction of the subject vehicle at the time of the impact with the stationary target shall be not less than the value specified in Table 1, column D of Annex 3~~

~~6.4.5.~~**6.5.4.** The emergency braking phase shall not start before a TTC equal to or less than 3.0 seconds **or as specified in paragraph 5.2.2.1., whatever is lower**.

Compliance shall be verified by either actual measurement during the test or using documentation provided by the vehicle manufacturer, as agreed between the Technical Service and the vehicle manufacturer.

6.6. Warning and activation test with a moving target

6.6.1. The subject vehicle and the moving target shall travel in a straight line, in the same direction, for at least two seconds prior to the functional part of the test, with a subject vehicle to target centreline offset of not more than 0.5m.

The functional part of the test shall start with the subject vehicle travelling at **at the test** speed ~~of 80~~ ± 2 km/h, the moving target at **a** speed of ~~the value specified in Table 1, column H of Annex 3~~ **13 km/h**, and a separation distance of at least 120 m between them.

From the start of the functional part of the test until the subject vehicle comes to a speed equal to that of the target there shall be no adjustment to any subject vehicle control by the driver other than slight steering adjustments to counteract any drifting.

Tests shall be performed at the vehicle maximum design speed and at each of the following speeds that is not greater than the vehicle maximum design speed: 40, 60, 80, 100 km/h.

Where this is deemed justified, the technical service may select additional test speeds between 15 km/h and the vehicle maximum design speed and other speeds of the moving target.

6.6.2. The timing for the collision warning modes referred to in paragraph 5.5.1. above shall comply with the **provisions as specified in paragraphs 5.2.1.1.1., 5.2.1.1.2. under consideration of paragraph 5.2.1.1.3.**

6.6.2.1. At least one ~~haptic or acoustic~~ warning mode shall be provided ~~no later than~~ **at the latest when the emergency braking phase is activated.**.

6.6.3. For relative speeds not exceeding the values as specified in paragraph 5.2.2.2., a collision shall be avoided, including a tolerance of 5 km/h.

For greater values, the relative speed reduction shall be as specified in paragraph 5.2.2.3., including a tolerance of 10 km/h.

~~6.5.2.3. Any speed reduction during the warning phase shall not exceed either 15 km/h or 30 per cent of the total subject vehicle speed reduction, whichever is higher.~~

6.6.4. The emergency braking phase shall not start before a TTC equal to or less than 3.0 seconds **or as specified in paragraph 5.2.2.1., whatever is lower**.

Compliance shall be verified by either actual measurement during the test or using documentation provided by the vehicle manufacturer, as agreed between the Technical Service and the vehicle manufacturer.

6.7. Failure detection test

6.7.1. Simulate an electrical failure, for example by disconnecting the power source to any AEBS component or disconnecting any electrical connection between AEBS components. When simulating an AEBS failure, neither the electrical connections for the driver warning signal of paragraph 5.5.4. above nor the optional manual AEBS deactivation control of paragraph 5.4. shall be disconnected.

6.7.2. The failure warning signal mentioned in paragraph 5.5.4. above shall be activated and remain activated not later than 10 seconds after the vehicle has been driven at a speed greater than 15 km/h and be reactivated immediately after a subsequent ignition "off" ignition "on" cycle with the vehicle stationary as long as the simulated failure exists.

6.8. Deactivation test

6.8.1. For vehicles equipped with means to deactivate the AEBS, turn the ignition (start) switch to the "or" (run) position and deactivate the AEBS. The warning signal mentioned in paragraph 5.4.2. above shall be activated. Turn the ignition (start) switch to the "off" position. Again, turn the ignition (start) switch to the "on" (run) position and verify that the previously activated warning signal is not reactivated, thereby indicating that the AEBS has been reinstated as specified in paragraph 5.4.1. above. If the ignition system is activated by means of a "key", the above requirement shall be fulfilled without removing the key.

6.8.2. **For vehicles equipped with means to deactivate the AEBS, turn the ignition (start) switch to the "on" (run) position and deactivate the AEBS. The warning signal mentioned in paragraph 5.4.4. above shall be activated. Accelerate the vehicle to a vehicle speed of greater than 30 km/h. The test is passed if the AEBS function is automatically reactivated and the warning signal mentioned in paragraph 5.4.2. above is automatically deactivated when the vehicle speed of 30 km/h is exceeded.**

6.8.3. **For vehicles equipped with means to deactivate the AEBS, turn the ignition (start) switch to the "on" (run) position. Drive the vehicle at a vehicle speed greater than 30 km/h and try to deactivate the AEBS function. The test is passed if the AEBS function is not deactivated after the deliberate action to deactivate the AEBS function has been carried out.**

6.9. False reaction test

6.9.1. Two stationary vehicles, of category M_1 AA saloon, shall be positioned:

(a) So as to face in the same direction of travel as the subject vehicle,

(b) With a distance of 4.5 m between them[3],

(c) With the rear of each vehicle aligned with the other.

6.9.2. The subject vehicle shall travel for a distance of at least 60 m, at a constant speed of 50 ± 2 km/h to pass centrally between the two stationary vehicles.

During the test there shall be no adjustment of any subject vehicle control other than slight steering adjustments to counteract any drifting.

6.9.3. The AEBS shall not provide a collision warning and shall not initiate the emergency braking phase.

7. Modification of vehicle type and extension of approval

7.1. Every modification of the vehicle type as defined in paragraph 2.2. above shall be notified to the Type Approval Authority which approved the vehicle type. The Type Approval Authority may then either:

7.1.1. Consider that the modifications made do not have an adverse effect on the conditions of the granting of the approval and grant an extension of approval;

7.1.2. Consider that the modifications made affect the conditions of the granting of the approval and require further tests or additional checks before granting an extension of approval.

7.2. Confirmation or refusal of approval, specifying the alterations, shall be communicated by the procedure specified in paragraph 4.3. above to the Contracting Parties to the Agreement which apply this Regulation.

[3] The point of reference of each stationary vehicle for establishing the distance between the two stationary vehicles, shall be determined in accordance with ISO 612-1978.

7.3. The Type Approval Authority shall inform the other Contracting Parties of the extension by means of the communication form which appears in Annex 1 to this Regulation. It shall assign a serial number to each extension, to be known as the extension number.

8. Conformity of production

8.1. The conformity of production procedures shall comply with those set out in the 1958 Agreement, Schedule 1 (E/ECE/TRANS/505/Rev.3), and meet the following requirements:

8.2. A vehicle approved pursuant to this Regulation shall be so manufactured as to conform to the type approved by meeting the requirements of paragraph 5. above;

8.3. The Type Approval Authority which has granted approval may at any time verify the conformity of control methods applicable to each production unit. The normal frequency of such inspections shall be once every two years.

9. Penalties for non-conformity of production

9.1. The approval granted in respect of a vehicle type pursuant to this Regulation may be withdrawn if the requirements laid down in paragraph 8. above are not complied with.

9.2. If a Contracting Party withdraws an approval it had previously granted, it shall forthwith so notify the other Contracting Parties applying this Regulation by sending them a communication form conforming to the model in Annex 1 to this Regulation.

10. Production definitively discontinued

If the holder of the approval completely ceases to manufacture a type of vehicle approved in accordance with this Regulation, he shall so inform the Type Approval Authority which granted the approval, which in turn shall forthwith inform the other Contracting Parties to the Agreement applying this Regulation by means of a communication form conforming to the model in Annex 1 to this Regulation.

11. Names and addresses of the Technical Services responsible for conducting approval tests and of Type Approval Authorities

The Contracting Parties to the Agreement applying this Regulation shall communicate to the United Nations Secretariat the names and addresses of the Technical Services responsible for conducting approval tests and of the Type Approval Authorities which granted approval and to which forms certifying approval or extension or refusal or withdrawal of approval are to be sent.

12. Transitional provisions

12.1. As from the official date of entry into force of the ~~0102~~ series of amendments, no Contracting Party applying the ~~0102~~ series of amendments to this Regulation, shall refuse to grant type approvals in accordance with the 01 series of amendments of this Regulation.

12.2. As from the date of entry into force of the ~~0102~~ series of amendments to this Regulation, Contracting Parties applying this Regulation may continue granting type approvals and extensions of type approvals to the ~~0001~~ series of amendments to this Regulation.

In accordance with Article 12 of the 1958 Agreement, Type Approvals may be granted according to the 00 or **01** series of amendments (former versions). Contracting Parties shall notify to the Secretariat General which version they apply. In the absence of notification of Contracting Parties to the United Nations Secretary-General, Contracting Parties will be considered to apply the ~~0102~~ series.

12.3. As from the date of entry into force of the ~~01~~ **02** series of amendments, no Contracting Party applying this Regulation shall refuse national or regional type approval of a vehicle type approved to the **02** series of amendments to this Regulation.

12.4. Until 1 January **2021**, no Contracting Party applying this Regulation shall refuse national or regional type approval of a vehicle type approved to the 01 series of amendments to this Regulation.

12.5. As from 1 January **2021**, Contracting Parties applying the ~~01~~ **02** series of amendments to this Regulation shall not be obliged to accept, for the purpose of national or regional type approval, a vehicle type approved to the ~~00~~ **01** series of amendments to this Regulation."

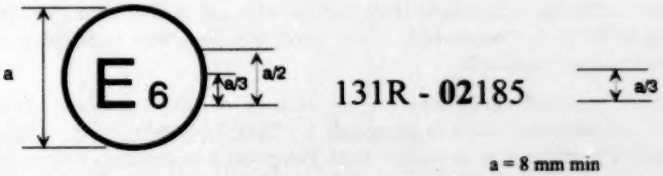
Annex 1, remains unchanged.

Annex 2, amend to read:

"Annex 2

Arrangements of approval marks

(See paragraphs 4.4. to 4.4.2. of this Regulation)



a = 8 mm min

The above approval mark affixed to a vehicle shows that the vehicle type concerned has been approved in Belgium (E 6) pursuant to Regulation No. 131. The first two digits of the approval number indicate that the approval was granted in accordance with the requirements of the **02** series of amendments to the Regulation No. 131"

Annex 3, shall be deleted.

Annex 4 (former), renumber as *Annex 3 (new)*.

II. Justification

1. The current text of UN Regulation No. 131 is written in a way that the technical requirements for AEBS functions (e.g. necessary speed reduction, timing for forward collision signals, etc) are provided in the test section and only for the test case, a collision test with the subject vehicle travelling at 80 km/h ± 2 km/h and the target being stationary or travelling at 13 km/h or 68 km/h, depending on vehicle class. The Regulation contains a mandatory warning phase in which only a limited speed reduction shall be achieved.

2. While this structure defines the conditions at the test case quite well, it hinders the performance at other speeds: due to the lack of specific requirements, type approval authorities typically require the mandatory warning phase with limited speed reduction for the whole speed range, and typically require it to have a duration of 1.4 seconds.

3. At lower travelling speeds, typically below 50 km/h for heavy vehicles, a forward collision warning with the aim to alert the driver of an imminent collision needs to be activated so early that it will occur during perfectly normal driving conditions. On the other hand, collisions involving a strong deceleration of the preceding vehicle escalate typically so quickly that no time should be wasted before activation of the AEBS emergency braking function.

4. To solve this situation, this proposal a) deletes in particular the requirement which limits the speed reduction during the warning phase and b) defines a time range for the warning function which takes into account that a warning is not effective for avoiding collisions at lower speeds (paragraphs 5.2.1., specifically 5.2.1.1.1. to 5.2.1.1.3.).

5. This proposal also introduces specific requirements for the achievable speed reduction for the cases of dry roads and wet roads. It defines an equation that allows to calculate the relative impact speed for cases where an avoidance is not possible (e.g. which are above the thresholds for required speed reduction). These modifications can be found in paragraph 5.2.2.. The equation shown in paragraph 5.2.2.3. describes the possible speed reduction for a given brake activation Time To Collision (TTC), given brake deceleration and given initial speed. The addition of half the brake deceleration increase time approximates the exact solution which would require numeric integration. To account for this approximation, a tolerance of 10 km/h should be taken into account.

6. UN Regulation No. 131 contains speed reduction requirements that current AEBS systems exceed by far, especially on stationary targets. Driving experiments show that current heavy goods vehicles under good conditions (e.g. on dry roads) are capable of avoiding collisions with stationary targets up to travelling speeds of more than 70 km/h. This performance can also be verified by calculations. On wet roads which offer a lower peak braking coefficient, calculations show that vehicles are capable of mitigating such collisions up to 40 km/h. Consequently, these speed reductions have been introduced as requirements in paragraph 5.2.2.2.

7. A major proposed modification in the structure of UN Regulation 131 is the definition of requirements (only) in paragraph 5 ("Specifications"), while paragraph 6 ("Test procedure") defines how to execute tests. Paragraph 6 as proposed defines generic performance tests which can be properly carried out at different speeds. Speeds between 20 and 100 km/h (if possible for the respective vehicle) and additionally at maximum vehicle design speed shall be tested, however the technical service is now allowed to perform tests

at different speeds. The load condition of the subject vehicle has been fixed to be maximum permissible vehicle mass.

8. A new requirement is introduced that requires provisions not allowing AEBS to be overruled by unconscious movement, e.g. by "falling" into the accelerator pedal (see paragraph 5.3.4).

9. A justification for the changes to the AEBS deactivation function has been provided already in ECE/TRANS/WP.29/GRRF/2017/24, for the introduction of sensor-blocking tests (paragraph 5.2.1.2.2.) in GRRF-86-32. It is anticipated that the changes to warning timing (effectively removing mandatory warnings for city speeds) and to the limitation of speed reduction in the warning phase will lead to fewer false warnings in cities and, consequently, there should be no technical challenges that would require a deactivation of the AEBS function for the complex traffic situations in cities (as it was referred to in GRRF-85-21 (third bullet point)). While GRRF-86-32 introduced provisions for detecting sensor blocking, it is anticipated that it will be more beneficial to address this problem by exempting the relevant vehicles by national legislation from the requirement to use UN Regulation No. 131.

10. Necessary definitions have been added, the introduction text has been modified and transitional provisions have been introduced that would make these changes effective by 1 January 2021.